What is claimed is:

1. A method for making a substrate for a mirror used in a photolithographic process for making a semiconductor device comprising:

forming a crystalline layer on a first layer, which has a low coefficient of thermal expansion; and

removing part of the crystalline layer to form on the first layer a second layer that has a high quality surface finish.

2. The method of claim 1 wherein the first layer comprises a low CTE glass or a low CTE alloy.

3. The method of claim 2 wherein the first layer comprises a material that is selected from the group consisting of a titanium silicate glass and a ceramic glass and the crystalline layer comprises silicon.

4. The method of claim 3 further comprising:

polishing and cleaning the first layer prior to forming the crystalline layer on the first layer;

forming a sacrificial layer that comprises silicon dioxide, which is grown by applying a rapid thermal anneal process to oxidize part of the crystalline layer; and

then removing the sacrificial layer.

5. The method of claim 4 wherein the silicon dioxide layer is grown to a thickness of less than about 10 nanometers.

6. The method of claim 5 wherein the silicon dioxide layer is removed using an isotropic etch process.

7. The method of claim 6 wherein the portion of the crystalline layer that remains after the silicon dioxide layer is removed is at least about 2 nanometers thick.

8. A method for making a mirror for photolithography comprising:

forming a crystalline layer on a low CTE layer that comprises a low CTE glass or a low CTE alloy;

converting part of the crystalline layer into a sacrificial layer;

removing the sacrificial layer; and then

forming a multi-layer coating on the remaining portion of the crystalline layer.

9. The method of claim 8 wherein the low CTE layer comprises a material that is selected from the group consisting of a titanium silicate glass and a ceramic glass and the crystalline layer comprises silicon.

10. The method of claim 9 wherein the sacrificial layer comprises silicon dioxide, and further comprising:

polishing and cleaning the low CTE layer prior to forming the silicon containing layer on the low CTE layer; and

applying a rapid thermal anneal process to grow the silicon dioxide layer.

11. The method of claim 10 further comprising growing the silicon dioxide layer to a thickness of less than about 10 nanometers.

12. The method of claim 11 wherein the silicon dioxide layer is removed using an isotropic etch process.

13. The method of claim 12 wherein the multi-layer coating comprises alternating layers of molybdenum and silicon.

14. A method for making a mirror for photolithography comprising:

forming a silicon containing layer on a low CTE layer, which comprises a low CTE glass or a low CTE alloy;

oxidizing the silicon containing layer to form a sacrificial silicon dioxide layer;

removing the sacrificial silicon dioxide layer; and then

forming on the remaining portion of the silicon containing layer a multi-layer coating that comprises alternating layers of molybdenum and silicon.

15. The method of claim 14 wherein the low CTE layer comprises a material that is selected from the group consisting of a titanium silicate glass and a ceramic glass.

16. The method of claim 15 further comprising:

polishing and cleaning the low CTE layer prior to forming the silicon containing layer on the low CTE layer;

applying a rapid thermal anneal process to grow a silicon dioxide layer that is less than about 10 nanometers thick; and

removing the silicon dioxide layer using an isotropic etch process.